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Abstract

EXPERIMENTAL INVESTIGATION ON PHYSICAL CHARACTERISTICS OF WATER-WATER REACTORS FOR SMALL POWER PLANTS

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This paper presents the experimental results on physical characteristics of water moderated and cooled reactors with uranium fuel enriched in U-235 up to 10-20 per cent. The results were obtained since 1959 through 1963. Such reactors are useful im small atomic power plants (including mobile plants). The analysis of experimental results, as a rule, is made on multigroup theory basis.

Critical assemblies (cold and hot) on which the experiments were performed are discribed in the report.

The main presented results are the following.

For more accurate determination of design values of fuel charge in cores and reactivity excess a number of critical assemblies were constructed. These assemblies differed in core content (types of fuel elements, fuel enrichment, lattice pitch, etc) and its configuration.

Excess reactivity determination of a full-sized core was carried out by integration of experimental values of $d\rho/dh$ against the core height. In these experiments core heigh variation was accomplished by a varaible charge of a heterogeneous absorber, by boron contaminating og the moderator, as well as by core radius variation. The common method of $d\rho/dh$ measurement was modified according to the peculiarities of the systems with a great number of channels with small

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passage section.

The great excess reactivity inherent to the reactors considered and the peculiarities of temperature effect of their cores compell severe requirements to the reactivity compensation organs. The paper contains the experimental results on determination of compensation effectiveness of rods with varaible construction and content (Eu,Ag, B,Cd) of compensating lattice and burning-out additives. In addition, results on determination of perturbation of heat release field by core lattice regularity disturbances (including the case of absorption change of controls).

The emphasis is made on the experimental investigation of interference of controls. The distribution of compensating unit functions according to their use for physical profiling water-water reactor cores is considered.

Considerable reactivity changes with temperature are inherent to water moderated and cooled reactors. Experimental results on studies of warm-up curves for such reactor cores within the temperature range from 20°up to 200°- 300°C are given in the paper. The warm-up of undisturbed (with regular lattice without compensating elements) cores as well as of critical assemblies with disturbed lattices practically accomplished in water reactors was carried out. Thermal neutron field variation across the lattice cell with temparature was investigated experimentally. Experimental data on control compensating effectiveness variation with core temperature are given in the report.